Average rate of change

When we calculate average rate of change of a function over a given interval, we're calculating the average number of units that the function moves up or down, per unit along the x-axis.

We could also say that we're measuring how much change occurs in our function's value per unit on the x-axis.

How do we find the average rate of change? Given the function and the interval we're interested in ($f(x)$ and $[x_1, x_2]$ respectively), our first step is to calculate the value of our function at both ends of the interval. Then we plug those values and the ends of the interval into our formula to find average rate of change.

The formula for average rate of change is

$$\frac{\Delta f}{\Delta x} = \frac{f(x_2) - f(x_1)}{x_2 - x_1}$$

over the interval $[x_1, x_2]$.

Example

Find the average rate of change over the interval $[0,4]$.

$$f(x) = 2x^2 - 2$$

We'll use the formula for average rate of change:

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$$\frac{\Delta f}{\Delta x} = \frac{f(x_2) - f(x_1)}{x_2 - x_1}$$

We already know that $x_1 = 0$ and that $x_2 = 4$. We'll find $f(x_1)$ and $f(x_2)$ by plugging 0 and 4 into the function we've been given, $f(x) = 2x^2 - 2$.

$f(0)$ is

$$f(0) = 2(0)^2 - 2$$

$$f(0) = -2$$

$f(4)$ is

$$f(4) = 2(4)^2 - 2$$

$$f(4) = 2(16) - 2$$

$$f(4) = 30$$

Plugging these values into the formula for average rate of change, we get

$$\frac{\Delta f}{\Delta x} = \frac{f(x_2) - f(x_1)}{x_2 - x_1}$$

$$\frac{\Delta f}{\Delta x} = \frac{f(4) - f(0)}{4 - 0}$$

$$\frac{\Delta f}{\Delta x} = \frac{30 - (-2)}{4}$$

$$\frac{\Delta f}{\Delta x} = \frac{32}{4}$$

$$\frac{\Delta f}{\Delta x} = 8$$

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The average rate of change of the function on $[0,4]$ is 8.

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